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C L A I M S

1. A process for the removal of H₂S and mercaptans from a gas stream comprising these compounds, which process comprises the steps of:

- 5 (a) removing H₂S from the gas stream by contacting the gas stream in a H₂S-removal zone with a first aqueous alkaline washing liquid to obtain a H₂S-depleted gas stream and a sulphide-comprising aqueous stream;
- 10 (b) removing mercaptans from the H₂S-depleted gas stream obtained in step (a) by contacting the H₂S-depleted gas stream in a mercaptan-removal zone with a second aqueous alkaline washing liquid to obtain a mercaptan-depleted gas stream and an thiolate-comprising aqueous stream;
- 15 (c) contacting the combined aqueous streams comprising sulphide and thiolates obtained in step (a) and step (b) with sulphide-oxidizing bacteria in the presence of oxygen in an oxidation reactor to obtain a sulphur slurry and a regenerated aqueous alkaline washing liquid;
- 20 (d) separating at least part of the sulphur slurry obtained in step (c) from the regenerated aqueous alkaline washing liquid; and
- (e) recycling the regenerated aqueous alkaline washing liquid to the H₂S-removal zone in step (a) and to the mercaptan-removal zone in step (b).

25 2. A process according to claim 1, wherein the regenerated alkaline washing liquid is recycled from the oxidation reactor to the H₂S-removal zone in step (a) and to the mercaptan-removal zone in step (b).

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3. A process according to claim 1 or 2, wherein the washing liquid in step (a) is buffered, preferably at a pH of between 4.5 and 10, more preferably at a pH between 5.5 and 9.
- 5 4. A process according to any one of claims 1 to 3, wherein the washing liquid in step (b) is buffered, preferably at a pH of between 5.5 and 10, more preferably at a pH between 6.5 and 9.
- 10 5. A process according to any one of claims 1 to 4, wherein the contents of the oxidation reactor in step (c) is buffered, preferably at a pH between 5.5 and 10, more preferably between 6.5 and 9.
- 15 6. A process according to any one of claims 1 to 5, wherein the H₂S concentration of the gas stream entering the H₂S-removal zone in step (a) is between 50 ppmv and 90 vol%, preferably between 100 ppmv and 70 vol%, more preferably between 150 ppmv and 50 vol%.
- 20 7. A process according to any one of claims 1 to 6, wherein the H₂S concentration of the mercaptan-depleted gas stream is less than 10 ppmv, especially between 0.01 and 10 ppmv, preferably between 0.05 and 3.5 ppmv, more preferably between 0.1 and 1 ppmw, based on the total mercaptan-depleted gas stream.
- 25 8. A process according to any one of claims 1 to 7, wherein the concentration of mercaptan compounds in the mercaptan-depleted gas stream is less than 6 ppmv, preferably less than 4 ppmv, more preferably less than 2 ppmv, based on the total mercaptan-depleted gas stream.
- 30 9. A gas-treating unit for the removal of H₂S and mercaptans from a gas stream comprising these compounds in a process according to claim 2, the gas treating unit comprising at least two gas scrubbers with inlets and outlets, at least one oxidation reactor with inlets and

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outlets and a solid/liquid separator with an inlet and
outlets, the first gas scrubber having a discharge line
for gas debouching into the inlet of the second gas
scrubber, the first and the second gas scrubbers both
5 having a discharge line for liquid debouching into the
oxidation reactor, optionally via a first and a second
flash vessel, respectively, the oxidation reactor having
an outlet debouching into the inlet of the solid/liquid
separator, an outlet for liquid debouching into the
10 inlets of the first gas scrubber and the second gas
scrubber.

10. A section according to claim 9, wherein the first and
the second gas scrubber are placed on top of each other
in one vessel.